



GASBOARD-3100P SERIES

PORTABLE INFRARED COAL GAS ANALYZER

USER MANUAL



No. Ver. 2012.3

Wuhan Cubic Optoelectronics Co.,Ltd

I Foreword

Thanks for using Portable infrared coal gas analyzer Gasboard-3100P series

1. Pls reading and using the operation manual carefully, to install, operate and repair the instrument after understanding the content completely. There would be happen to human injury or analyzer damage if your operation unqualified.
 2. Never remove the configuration and spare parts of the instrument unless approving by company. Our company will be derelict of duty due to the user make bold to remove the configuration and spare parts mistakenly.
 3. The specification and guide content of this analyzer may be change due to the technology improve of the product. Pls forgive us shall not give out an inform previous.
 4. This operation manual have to give the practice user to save, and put the user can refer to it at any moment.。
 5. Our company the final explanation to use the analyzer.
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II Products Consignment Listing

No.	Descriptions	Quantity (unit)	Remarks
1	Gasboard-3100P portable coal gas analyzer	1 (set)	
2	Sampling pipe	1 (pc)	
3	RS232 cable	1 (pc)	
4	Gas conditioning system(Optional)	1 (set)	To remove dust and water vapor
5	AC 220V power adapter	1 (pc)	
6	Calibration report	1 (pc)	
6	Users Manual	1 (pc)	



Actually deliver the goods is different according to the different contract requirements, please check the packing list carefully after receive the analyzer, and fill in the return receipt of the consignee. Don't hesitate to contact the customer service department if there is any unconformable content with the packing list.

III Using Attentions



The notice in this operation manual related to the human safety and the analyzer function, pls follow it carefully. The meanings of attention signals are as follows:

Signals	Brief Description	Additional Instruction
	Dangerous	There would be happen to dangerous and come out serious result if the operation is misplay, such as human safety.
	Caution	There would be happen to dangerous and make out moderate injure or analyzer destroyed if the operation is misplay.
	Electric Shock	There would be happen to dangerous and electric shock if the Operation is misplay.
	Forbidden	Not permit to operation in normally.


i. Notice for the Analyzer Installation

	<ul style="list-style-type: none">■ Analyzer specification have not mentioned against burst, never install the analyzer in the environment with the exploded gas, otherwise, there would be happen to burst and fire, endanger human safety.
	<ul style="list-style-type: none">■ Analyzer have to install in the location, where is smoothly and can be bear the analyzer weight, avoid the analyzer from overturn and falling.■ Analyzer should be avoid from strong shine, wind and moisture.■ During in the analyzer install periods, pls avoid the powder and water from the analyzer inside, otherwise the analyzer will be worked in trouble.



ii. Notice for the Gas Route Connection

	<ul style="list-style-type: none">■ Gas route connection should be strict carry out according to the direction of this operation manual, and guarantee the integrity of the pipe line, avoid the pipe line fall of or leak due to the excessive pressure. If the leaked gas is poisonous and explode gas, there would be happen to serious accident.■ Enter air pressure of the analyzer have to guarantee in the apparatus stipulate range, avoid the pipe fall off or gas leak due to pressure excessive.■ Pls connect the vent-pipe to the outdoor with atmosphere environment, never put it in to the sampling equipment or indoor.
	<ul style="list-style-type: none">■ The sampling gas route of the analyzer should make well pretreat according to the idiographic circs of the sampling gas, otherwise, the analyzer can not work in gear.■ Never use the sampling apparatus, which attached with oil fat, such as pipe and decompress valve. The gas route will be jammed or happened fire accident if the oil fat attached in the sampling apparatus.



iii. Notice for the Electrocircuit Connection

	<ul style="list-style-type: none"> ■ Ensure shut off the power supply during set and connect the string process, otherwise, there would be happen on electric shock accident. ■ Pls insure connect the grounding columniation on the analyzer to the ground and carry out according to the regulation, otherwise, there would be happen on electric shock accident or analyzer be in trouble. ■ Circuit connection string have to use the suitable materials, Otherwise, there would be happen to fire accident or make the analyzer worked in trouble. ■ Pls shut off the analyzer and the PC power firstly if there need to install serial port data transmission line. ■ Pls check the insulated electrical string to connect the power didn't destroyed, otherwise, there would be happen to electric shock accident.
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iv. Notice for the Analyzer Application

	<ul style="list-style-type: none"> ■ No smoking and bright fire near to the analyzer, or else, there would be happen to fire accident. ■ Pls reading the standard gas carefully before correct performance when you used the standard gas which used for adjust the analyzer, otherwise there would be happen to high gas voltage injury or poison gas leak. ■ Never let the moisture immerge analyzer, otherwise, there would be happen to electric shock accident or appearance inside short circuit.
	<ul style="list-style-type: none"> ■ Never running the analyzer for a long time when the cover is open, otherwise, powder, oil and other sundries will be gathered in the analyzer inside, and make the analyzer in trouble. ■ Never shut off or turn off the analyzer power supply optionally, otherwise, the analyzer life will be shorten, even the analyzer will be destroyed. ■ You have to use the normal national standard gas to adjust the analyze according to the application guide to operation, so that guarantee the analyzer measure precision. ■ You have to guarantee the sampling gas make pretreatment process via remove the water, dust, oil etc. when you are measure precision. Otherwise, it would be infect the analyzer's measure precision.

v. Notice for the Analyzer Maintenance

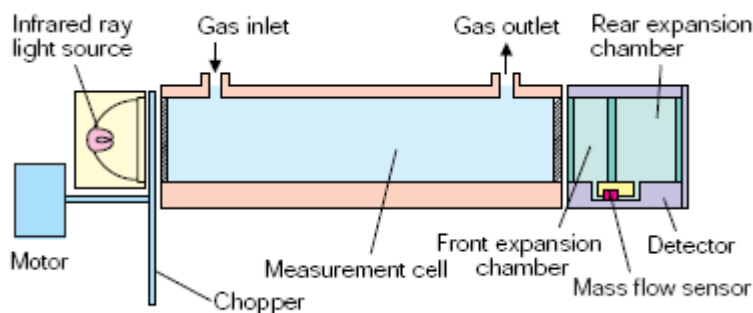
	<ul style="list-style-type: none"> ■ Pls shut off the power supply when you maintaining the analyzer, avoid from the electric shock accident.
	<ul style="list-style-type: none"> ■ Analyzer apparatus should be maintained timely, never impacted and inbreathe the powder in to the analyzer. ■ Pls shut off all the power and save it up carefully if you will not use this analyzer for a long time, avoid it from the sun shine or moisture environment.

1 Abstract

GasBoard-3100P is based on NDIR technology to measure the gas concentration of CO, CO₂, CH₄ and C_nH_m(optional), based on TCD(MEMS) to measure the gas concentration of H₂, and based on ECD to measure the gas concentration of O₂ at the same time in one analyzer. The BTU calculation is available in Gasboard 3100P..

1.1 NDIR principle

CO, CO₂, CH₄, C₃H₈, NO and other molecules by heterogeneous atoms in the infrared wavelength region with the absorption spectrum, its absorption intensity follows Lambert - Beer's Law. When corresponding to a characteristic absorption wavelength of the light waves of gas through the gas is measured, its intensity will be significantly weakened, the intensity of the gas concentrations in the degree of attenuation related to the relationship between compliance with Lambert - Beer law. The basic principle of NDIR sensor structure, shown below,



The basic mathematical model is as follows: most of the organic and inorganic multi-atomic and molecular gases in the infrared region have a specific absorption wavelength. When the infrared light passes through, these gas molecules through the specific wavelengths of light intensity by the Lambert - Beer law, said: $I = I_0 e^{-kpl}$, absorption of light intensity i can be expressed as: $i = I_0 - I = I_0 (1 - e^{-kpl})$. Where, I_0 is the incident light strong; I is through the light intensity; l is the thickness of the gas medium, p is the gas density, k is the absorption coefficient.

1.2 Features and Applications

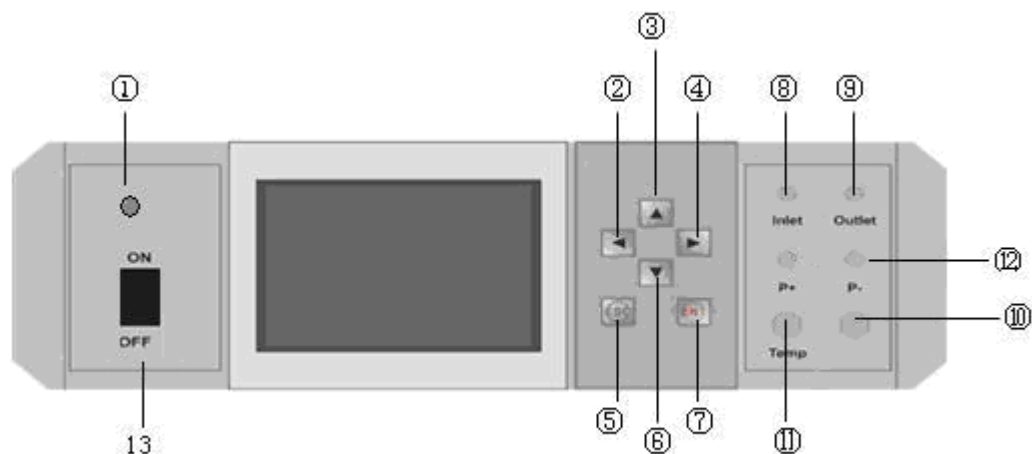
This product is applicable to iron and steel, ferro alloys, sponge iron smelting process gas analysis (including blast furnace, BOF, coke oven, heat treatment, gas furnace, calcium carbide furnaces), cement shaft kiln flue gas composition measurements (flue gas oxygen content, air excess coefficient of determination), straw biomass gasification process gas analysis (gas concentrations, heat value of monitoring), gas recovery and utilization of the heat value of the process of monitoring, industrial gas applications in the process of environmental protection.

1.3 Specifications

Components	Method	Range	Resolution	Precision	
CO ₂	NDIR	100%	0.01%	≤2%	
CO	NDIR	100%	0.01%	≤2%	
H ₂	TCD	100%	0.01%	≤3%	
O ₂	ECD	25%	0.01%	≤3%	
CH ₄	NDIR	50%	0.01%	≤2%	
C _n H _m	NDIR	10%	0.01%	≤2%	
Note: Measurement range can be customized by the requirement. Max: 6 components at the same time.					

Response Time (T _D +T ₉₀)	<10s (NDIR)
Response Time	15min
I/O port	RS232
Work temperature	0~50℃
Relative humidity	5~85%
Ambient air pressure	86~108kPa
Power supply	AC 220±10%V 50Hz±1Hz
Weight	About 3.5kg

1.4 Front Panel



1 --- Charger port

2 ---Left (record)

3 --- Up (open Pump)

4 ---Right (zero)

5 --- ESC

6 ---Down (close Pump)

7 --- ENT

8 ---Gas inlet

9 --- Gas outlet

10 --RS232 serial port

11 ---Temperature (reserved)

12---Auto zeroing ports

13---Power on/off

2 Operation

2.1 Power on/off

- Connect the power cable into power supply socket of gas analyzer, and then provide the AC220V power source;
- To switch on/off the power to open/close the gas analyzer.(I means open, O means close)
- ※ **Please make sure the gas analyzer isn't working before closing it.**

2.2 Zero

Once the power is on, warm-up will be taking 15 minutes. Press “→” to do zero. During the Auto-Zero process, the air will be absorbed by gas analyzer for 150 seconds automatically. Then Auto-zero process is finished.

3 Gas Measurement

Gas analyzer can analyze gas concentration. After warming-up and Zero, the gas analyzer will enter the system as below:

<u>Gas Analyzer</u>	
CO:00.00%	CO2:00.00%
CH4:00.00%	H2:00.00%
O2:00.00%	
	0000 Kcal/m3
2010-06-9	00: 00: 00
<hr/>	
[Esc]Return ▲Open pump ▼Close pump ◀Record ▶ Zero ENT	

3.1

Coal components

measurement

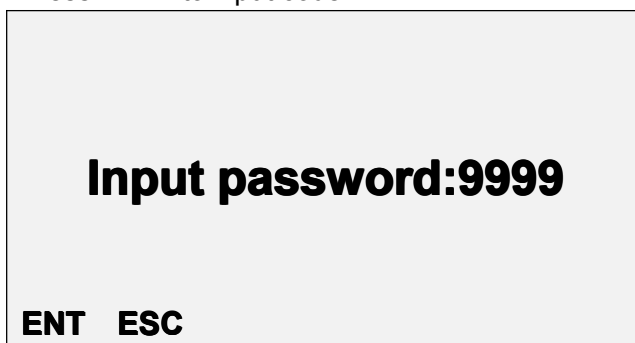
Steps	
A	1. Connect power supply 2. Open the power on; warm up for 15m
B	1. Put sampling tube into the coal gas pipe. 2. Open sampling pump, then sampling is starting.

4 Setting

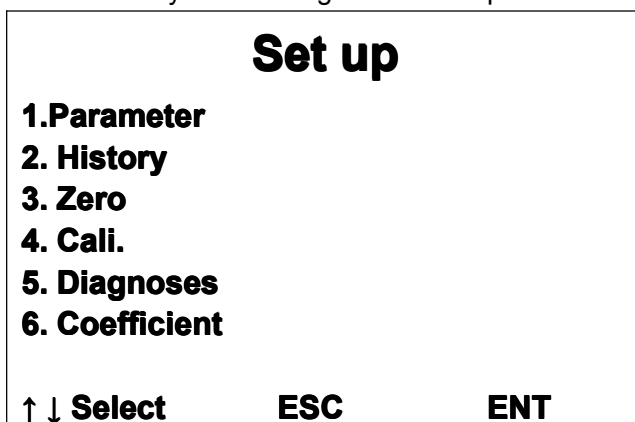
System Setting

Steps:

- 1) Press "ENT" to input code.



- 2) Press "ENT", alter number through up/down, value adds one by pressing "up" once, value reduces one by pressing "down" once.
- 3) Move cursor through left/right. Press "ENT" when you finish outputting. System will automatically enter into "system setting" interface if password is correctly entered.



- 4) Select different system settings through up/down, press "ENT" to enter in related interface.
- 5) Press "ESC" to return to measuring interface.

Part I. Parameter setting

Move highlight to "parameter" through "up/down". Press "ENT" to enter in "parameter" interface. System setting includes backlight, password change, language setting, time setting and negative (under zero).

Set up

1.Parameter
2. History
3. Zero
4. Cali.
5. Diagnoses
6. Coefficient

↑↓ **Select** **ESC** **ENT**

■ Backlight setting

steps:

- 1) Move highlight to “backlight setting” , press “ENT” to enter in.
- 2) “Backlight setting” offers six options. (15sec , 30sec, 5min, 10min, ON, OFF) . Move highlighting to related option, press “ENT” to save.
- 3) Press ”ESC” , return to “parameter setting”.

Parameter

1. Backlight **5 min**
2. Password
3. Language
4.Time Setting
5. Negative

↑↓ **Select** **ESC** **ENT**

■ Password change

steps:

- 1) Move highlight to “password change”, press “ENT” to enter in.

Parameter

Input password:

1.Backlight
2.Password **9999**
3.Language
4Time
5.Negative

↑↓ **Select** **ESC** **ENT**

- 2) By pressing “ENT”, cursor will appear below “Input Password”. Alter number through up/down.
- 3) Move cursor through left/right. Press “ENT” after input
- 4) Enter in “password change” interface if password is correctly entered.

Parameter

New password:

1.Backlight

2.Password

3.Language

4Time Setting

5.Negative

0000

↑ ↓ **Select**
ESC
ENT

5) Press “ENT” , alter number through up/down

6) Move cursor through left/right to change input position. Press “ENT” to enter in “confirm password” interface.

Parameter

Confirm password:

1.Backlight

2.Password

3.Language

4Time Setting

6.Negative

0000

↑ ↓ **Select**
ESC
ENT

7) Press “ENT”, alter number through up/down.

8) If you enter password identically, system will save set password. Or else, system will remind the mistake and return to “parameter setting”.

■ **Language**

steps:

1) Move highlight to “language”, press “ENT” to language setting interface.

Parameter

1.Backlight

2.Password

3.Language

4Time Setting

5.Negative

English

↑ ↓ **Select**
ESC
ENT

2) Select language by press “ENT”. English version and Chinese version are available.

■ **Time setting**

steps:

1) Move highlight to “Time Setting” through up/down. Press “ENT” to enter in time setting interface.

Parameter		
1.Backlight	YY-MM-DD	HH:MM
2.Password	08-02-27	15:10
3.Language		
4.Time Setting		
5.Negative		
↑ ↓ Select	ESC	ENT

2) Press “ENT”, alter number through up/down.

1) Move cursor through left/right. System will return to “parameter setting” after input

■ Negative (Under Zero)

Under parameter setting interface, to move cursor to Negative by pressing Up and Down keypad, then press ENT to change it from OFF to On.

Parameter		
1. Backlight		ON
2. Password		
3. Language		
4. Time		
5. Negative		
↑ ↓ Select	ESC	ENT

Part II. History

When the cursor moves on the “History”, press “ENT” to enter it.

Set up	
1.Parameter	Browse
2. History	Delete All
3. Zero	Set Interval
4. Cali.	
5. Diagnoses	
6. Coefficient	
↑ ↓ Select	ESC ENT

■ View History record

It can check history data, including: data number, gas concentration.

SN means site number. Press Up or Down to browse all the data. Press Right button to delete data.

Press ENT to check next group of data. Press ESC to return. There are altogether 1500 groups data

can be recorded.

- Delete All

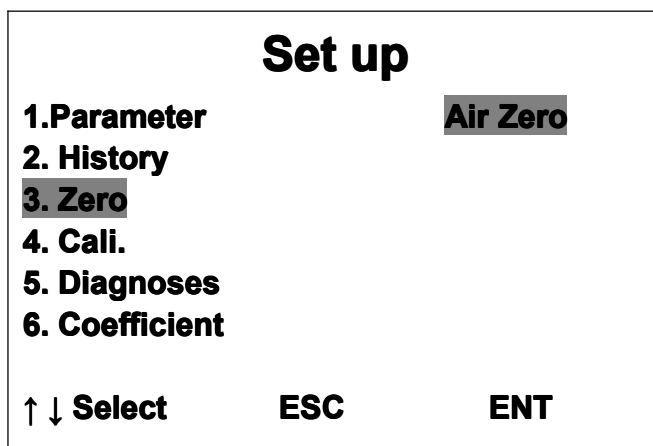
You can delete all the record data by this function

- Set Interval

You can set record frequency by this function.

Part III. Zero

When the cursor moves on the “Zero”, press “ENT” to enter it. There are two ways to do zero. One is pressing “→” button, the other is to do zero in software. Zero is recommended to do before you are using the gas analyzer.



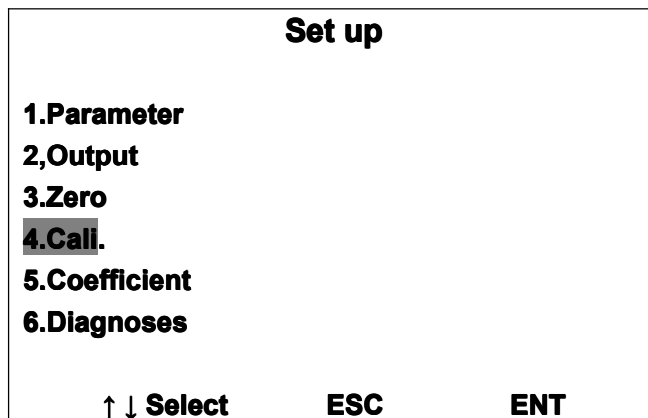
Part IV. Calibration

About calibration:

- In order to ensure the precision of the instrument, we recommend warm-up should be finished, and then implement the calibration operation.
- Calibration includes Zero calibration and Span calibration, which should be implemented continuously, then the result will be saved.
- The pressure of calibration gas should be controlled between 2 and 3 kPa, the gas flow should be controlled between 0.7 and 1.2L.min.

Operation Method:

- 1) Under system setting interface, to move cursor to Calibration, then press ENT to enter into calibration interface.



2) Zero Calibration(CO2 for example)

Zero Calibration			
Unstable			
	AD	Test	Input
CO	4440	00.00	**.**
CO2	3505	-0.11	**.**
CH4	3689	00.00	**.**
H2	3042	-0.60	**.**
O2	1497	20.44	**.**
	Next	Save	
↑ ↓ Select	ESC	ENT	

- Please lead the high pure N2 into gas analyzer continuously.
- To move cursor to Input CO2Vol(%) by pressing Up and Down keypad.
- Press ENT, then to input the gas concentration by press Up and Down keypad. (**Normally you should input 0000 for zero calibration**)
- To change numbers by pressing Left and Right keypad. After finishing it, press ENT to confirm it.
- When the calibration status becomes **Stable** from **Unstable**, o move the cursor to Save by pressing Up and Down keypad, then press ENT to save the Zero calibration. It will turn to Span calibration automatically.

3) Span calibration(CO2 for example)

- Please lead the high pure CO2 into gas analyzer continuously.
***The selected standard calibration gas concentration should be at 80%~100% of measurement range. For example, if the measure range of CO2 is 50%,the standard calibration gas concentration should be at 40%~50%**

Span Calibration			
Unstable			
	AD	Test	Input
CO	4440	00.00	**.**
CO2	3505	-0.11	**.**
CH4	3689	00.00	**.**
H2	3042	-0.60	**.**
O2	1497	20.44	**.**
	Next	Save	
↑ ↓ Select	ESC	ENT	

- To move cursor on CO2 Vol(%) by pressing Up and Down keypad.
- Press ENT, then to input the gas concentration by press Up and Down keypad.(**You should input the concentration the same as what you take for standard gas**)
- To change numbers by pressing Left and Right keypad. After finishing it, press ENT to confirm it.

- E. When the calibration status becomes **Stable** from **Unstable**, to move the cursor to Save by pressing Up and Down keypad, then press ENT to save the Span calibration.

Calibration for other gases

- A. The calibration of CO,CH₄,H₂,CnHm and O₂ is the same as CO₂
B. Standard gas for zero calibration should be N₂. Standard gas for span calibration is the same as corresponding gases.

Part V. Diagnoses

When the cursor moves on the “Diagnoses”, press “ENT” to enter it. You will find Sensor Signal inside.

Set up

1.Parameter
2. History
3. Zero
4. Cali.
5. Diagnoses
6. Coefficient

↑ ↓ Select ESC ENT

Sensor signals

Ch	ADC	n	Ch	ADC	n
00	0000		09	3720	COtst
01	0000		10	3647	CO2ref
02	3025	H2	11	3549	CO2tst
03	2192	Bat	12	3549	CH4
04	3809	O2	13	3549	CH4tst
05	0000		14	3549	CnHmref
06	3038		15	3549	CnHm
07	0000	Press			
08	3898	COref			

↑ ↓ Select ESC ENT

Part VI. Coefficient

Under set up interface, to move cursor to coefficient, then enter into following interface

Set up

1.Parameter

2. History

3. Zero

4. Cali.

5. Diagnoses

6. Coefficient

CHV or LHV: LHV

CO HV Amp.: 1.000

CH4 HV Amp.: 1.000

CnHm HV Amp.: 1.000

H2 HV Amp.: 1.000

HV unit: Kcal/m3

CH4 self Coef: 1.000

↑ ↓ Select

ESC

ENT

5Trouble shooting

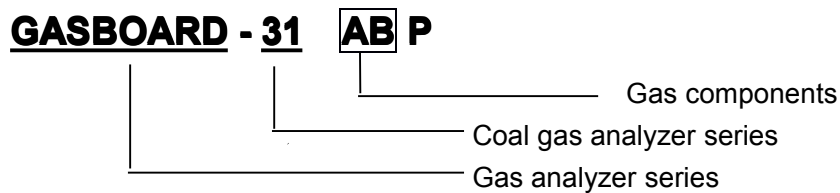
Problems	Possibilities	Solutions
No response after power on	No power supply; Power cable is broken; Fuse is broken	replace the damaged parts. (fuse is fixed under the power supply.)
After power on, there is no image, or white screen.	Ambient temperature affect LCD; The contrast setting of LCD is abnormal.	After warming-up, you can press UP or DOWN to adjust LCD's contrast under the status of measure interface until it gets the best effect of the screen.
There is no flow or little flow.	Sampling system malfunction; Sampling gas in port is leak; Vent or pipe is choked.	Check sampling system to exclude external problems. Tighten sampling gas line; change sampling tube Check vent or change pipe
Measurement numerical value's response is slow; the change range of measurement numerical value is small or no change.	Sampling gas cell is leak; Dust filter is choked;	Check sampling system, according to the solution of There is no flow or little flow; Change dust filter paper.
The change range of measurement numerical value is big, which surpass the error of permit.	Instrument warm-up time is not enough; sampling is not stable.	Start instrument and warm up for 10 minutes. check sampling system.
Can not to zero after testing .	Emission gas still in the gas cell; Effect of instrument's zero drift	Use the pump to pump out the rudimental gas; Implement zero or user calibration.



- ◆ After checking above, if trouble is still existing, please contact with manufacturer as soon as possible.
- ◆ Laypeople or the status of no permit from manufacturer, please don't install and dismantle machine by yourself, or the manufacturer has right to refuse to repair and maintain it.
- ◆ Please read the manual carefully before using the analyzer, Wrong operation will do damage to person and the analyzer

6 Configuration

GASBOARD-3100P can be following combination:



AB	Com pone nts	AB	Components	AB	Components	AB	Components
01	CO	20	2gases	30	3gases	40	4gases
02	CO ₂	21	CO+ CO ₂	31	CO+ CO ₂ + CH ₄	41	CO+ CO ₂ + CH ₄ + O ₂
03	CH ₄	22	CO + CH ₄	32	CO+ CO ₂ + O ₂	42	CO+ CO ₂ + CH ₄ + H ₂
04	C ₃ H ₈	23	CO+ O ₂	33	CO+ CO ₂ + H ₂	43	CO+ CO ₂ + O ₂ + H ₂
05	O ₂	24	CO+H ₂	34	CO+ CH ₄ + O ₂	44	CO+ CH ₄ + O ₂ + H ₂
06	H ₂	25	CO ₂ + CH ₄	35	CO+ CH ₄ + H ₂	45	CO ₂ + CH ₄ + O ₂ + H ₂
07	H ₂ S	26	CO ₂ + O ₂	36	CO+ O ₂ + H ₂	50	5gases
08	NO	27	CO ₂ + H ₂	37	CO ₂ + CH ₄ + O ₂	51	CO+ CO ₂ + CH ₄ + O ₂ + H ₂
09	SO ₂	28	CH ₄ + O ₂	38	CO ₂ + CH ₄ + H ₂		
		29	CH ₄ +H ₂	39	CO ₂ + O ₂ + H ₂		

7 Customer consultation and Service:

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